

# WORLD'S FIRST COMPUTER STORE

The World's First Retail Computer Store, The Computer Store, is now open for business in West Los Angeles. It is located at 11656 Pico (at Barrington) 1/4 mile west of the San Diego Frwy. (phone 213-478-3168).

Owned and operated by Dick Heiser, The Computer Store is an offshoot of the Arrowhead Computer Company. Not too surprisingly, The Computer Store features the Altair 8800 in both kit and assembled units along with Altair I/O's, (Parallel, Serial RS-232, Serial TTL, and Serial TTY), and Altair memory (1K and 4K boards). That's right, you can walk right in off the street, put down your money and walk out with your own Altair computer!



The Computer Store

The store also has an Altair 8K BASIC language system connected to a Teletype for demonstration purposes.

Besides selling Altairs, Heiser is making his store available for a number of services including kit assembly advice, software information, and a meeting place for computer hobbyists. Store hours are Wednesday through Friday, 2pm-8pm and Saturday-Sunday, 1pm-6pm.

Contacted by Computer Notes, Heiser reported that business has been very brisk and that he is doing much better than he ever imagined.

"People in this business haven't been optimistic enough," said Heiser, "I've tried to be as optimistic as possible but that has turned out to be too conservative. You have to be wildly optimistic!"

## COMPUTER NOTES

August, 1975

© MITS, INC. 1975

Volume One Issue Three

A PUBLICATION OF THE ALTAIR USERS GROUP

## MITS-MOBILE HITS SE

The MITS-MOBILE is on the road again--this time making stops throughout the Southeastern section of the United States.

The new driver and lecturer of the MITS-MOBILE (he refers to himself as the "van man") is Mike Hunter who originates from Miami where, among other things, he worked as a Custom Engineer for IBM.

Mike's computer experience includes knowledge of APL, Fortran, Cobol, BASIC and basic logic circuitry. Besides having a great deal of experience with the Altair 8800, Mike has also worked with the IBM 370 and Honeywell computers.

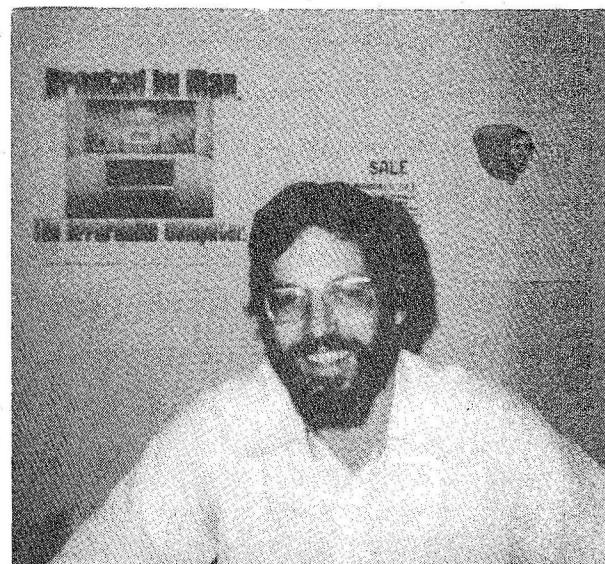
Mike will be teaching computer seminars at major Southeastern population centers. These seminars are divided into four sections covering (1) introduction to computers, (2) Altair 8800 hardware and interfacing techniques, (3) programming in machine

language, assembly language, and Altair BASIC, and (4) questions and answers.

Participants in the seminars will each receive an Altair binder filled with a course outline, technical data and other good stuff. There will be a slide presentation, a door prize, refreshments and hands-on demonstration both before and after the seminar.

All seminars will be held at Holiday Inns (see schedule on page 3). Cost of the seminars is \$9.75 per person. Interested persons are asked to make reservations before-hand by mailing a check to MITS (note "Altair Caravan" on envelope). A limited number of tickets are available at the door in most locations.

--SEE PAGE 3 FOR SCHEDULE--



Dick Heiser

Heiser, who is an active member of the Southern California Computer Society, is also marketing computer books and literature. His book list is basically the same as that at People's Computer Company and includes BASIC by Albrecht, Finkel & Bron, BASIC BASIC by James Coan, COMPUTER LIB & DREAM MACHINES by Theodore H. Nelson, DRAGON SHIRTS by Nancy Hertert, MY COMPUTER LIKES ME by Dymax, 101 BASIC GAMES by David Ahl, and many others.

In the future, Computer Notes will carry progress reports about The Computer Store and articles about other Altair retail outlets which will soon be opening across the country.

**MITS/6328 Linn NE/Albuquerque, NM 87108/ 505-265-7553 — see secret # page 3**

Rumors, Clarifications, and Who's Pulling Your Leg**Across the Editor's Desk**

by David Bunnell

Let's face it-- the Altair 8800 is a revolutionary development that is having quite an impact.

Now in this business, revolutions come and go. However, I think it is safe to assume that the Altair has made its mark.

Because of this, the Altair 8800 has received a considerable amount of press coverage. Some of this coverage has been good, accurate reporting with constructive criticism and some of it has been based on rumors and faulty information.

For instance, one hobby publication ran an article stating that MITS had yet to deliver 4K boards when at the time the number of delivered Altair 4K boards was in the thousands.

One point that has gotten us good press in a number of publications is that we try to level with our customers. When we make a mistake we publish it in Computer Notes.

So, let's clear the air:

ITEM: Off-brand peripherals, memory cards, etc.

There is very little we can do or even want to do to prevent Altair 8800 customers from using these devices. The days of Big Brother Computer Company requiring Big Brother users to use Big Brother peripherals are over-- period.

However, this does not mean that we don't intend to be competitive. One obvious example of this is the structure of our software prices. Purchasers of an Altair 8800 plus X amount of Altair memory plus an Altair I/O card receive a discounted price on Altair software.

If you buy a certain amount of Altair equipment from us we can afford to give you a break on software. If you just buy an Altair 8800, we can't afford to give you the same break.

Another point in this area is that we cannot be responsible under our warranty for repair problems that result from customers using off-brand add-ons and we can't be responsible for interfacing these devices. This, I think, should be understandable.

Anyway, off-brand add-ons are a testimony to the success of Altair and the faith among other manufacturers that the 8800 is here to stay for a long time.

Someone recently showed us a 4K board that's been widely advertised. We checked it out and found that while it was an attractive board it uses almost 4 times the power of an Altair 4K Board. This means that you are going to run short on power rather quickly as you develop your machine.

The Altair 8800 was designed to power up to 16 Altair boards. If you run out because you're using

some other types of memory or I/O boards-- well, that can't be our responsibility.

ITEM: Intel 8080 chips that are less than full specification.

A rumor that we have done something about is the rumor that MITS uses inferior 8080 chips (how else could we market the Altair 8800 for \$439).

This rumor is absolutely untrue. It is a lie.

Unfortunately, those responsible for this rumor include field salesmen for Intel who were hard pressed explaining our low price to potential customers. (\$439 for an Altair compared to something like \$350 for a single 8080 chip).

Thanks to help from Intel executives, this rumor has at least been partially put to rest (see Intel letter reprinted on this page).

ITEM: Software Agreement. Software costs us a lot of bucks. Therefore we can't allow people to copy our software and we will prosecute anyone who violates their license agreement.

However, peripherals or memory boards or I/O boards you have built yourself or obtained from another source need not be included on your designated equipment list. We would like to have this information just so we can keep an eye on what's happening, but you aren't required to submit it.

While the agreement does forbid you from running MITS software on someone else's computer, this should not be interpreted to mean that you can't do program development on a larger machine. MITS recognizes the advantages of such an approach and there will be no objections raised to Altair software's being used on other machines if the use is restricted to development of programs to be run on Altairs.

ITEM: 6800 CPU Chip. Yes, MITS is working on developments around this chip. However, it is absolutely not true that we have any plans, notions, thoughts or intentions of replacing the 8080 CPU with a 6800 CPU.

The Altair 8800 is our most powerful processor and it will remain our most powerful processor for a considerable length of time. Altair 8800 development programs are in high gear and Altair 8800 owners can be assured that we intend to support them now and indefinitely into the future.

ITEM: Delivery. We have had complaints about delivery and in some cases we have had problems in this area. However, all things considered, we are doing quite well.

For instance, the Altair 8800 in kit form is approaching the point where it is going to be an off-the-shelf item. And this should not be interpreted to mean sales

are down (mail order business is usually down in the summer-- this summer our sales have actually gone up).

If you order an Altair 8800 kit and pay for it by personal check it takes 3 weeks to clear your check and this, obviously, is the cause of many of our delays. If, however, you order an Altair 8800 kit and pay for it by money order, cashier's check or by BankAmericard or Master Charge, it takes only 2 or 3 days to process your order.

Other kit items that are approaching off-the-shelf status include the 1K and 4K memory boards, the parallel and all three serial I/O boards, the ACR board, and 8K BASIC language.

The CT256 and the COMTER II have been delayed for case modifications but we hope to have them back on the track by the end of August.

As for ASR-33 Teletypes-- we have sold out our stock but we are looking for a new delivery by September which is also the time schedule for delivery of Altair Line Printers.

One problem we have had with assembled units is that many orders specify that they will not accept partial shipments. This means if you have ordered a Real Time Clock or a Vectored Interrupt your shipment will be held up until these two items are being shipped. (November 1st).

The point is: we may not be perfect, but we have a pretty damned good track record.

**40**  
hank o'hara  
sales bits

TO: All Field Sales  
FROM: Hank O'Hara  
SUBJECT: MITS ALTAIR 8800 MICROCOMPUTER

We wish to clarify any misconceptions that may exist in your minds regarding the MITS ALTAIR system. This product is designed around the Intel Standard Data Sheet 8080 family. The immediate market acceptance of the Altair system should serve as an opportunity indicator for Intel's MCS product family to all of us. It demonstrates in clear terms what a creative designer can achieve with Intel's products.

MITS is a valued customer to Intel. MITS should receive the same support from Intel field sales as any other major customer when these successful users of Intel products are used to support sales presentations to prospective customers for future applications of our MCS product family.

Any presentations of our MDS-800 and other Intel products to prospective customers should be based on the positive merits of our products only. It is not necessary to make derogatory comments regarding any competitive manufacturer of MCSTM type products that use Intel MCS components. The use of such statements is to be avoided at all times.

Your total cooperation in seeing that these suggestions are followed will be appreciated.

*Hank O'Hara*  
Hank O'Hara

/aj

NP358-0775-400

intel

## ALTAIR SERVICE DEPT.



Barbara Sims

Well here we are once again! Our schedule for the newsletter seems to be getting much better wouldn't you say? I have a couple of new suggestions to pass on to you that will help us out tremendously.

If you need to send a unit or board in for repair, it would help considerably if you'd include the name the unit was purchased under (i.e. surname, company or school name). Also we need an enclosure describing the problem(s) you're having with the unit. Due to the amount of mail coming into our office, it is very difficult to match repair shipments with letters that come in separately. If our service department does not have a complaint to work from, it takes a little longer to locate problems.

Some of our users have received defective parts. We'll be glad to replace anything that is defective, but you need to send the defective part in first, then we'll get a good one out to you right away. Again you need to enclose a note and always show the name the 8800 was purchased under.

Our software library is coming along. We still need entries, though. As of September 1, 1975 we will be putting a new policy into effect. Your cooperation will be appreciated. No more programs will be acceptable unless they are type written on our software program format (sample enclosed). It is too difficult for us to keep up with typing the programs for printing. The programs must also be on good quality paper 8 1/2 by 11" (not onion skin or any light weight paper.) The typewriter ribbon used must be black with a good contrast. Without these stipulations, our printer will not run copies of your program. In addition make sure that you keep a copy of your program on file, as we cannot return programs that are not accepted into our library.

We sent out software license agreements for BASIC to all our Altair customers. If you have ordered software, or order it in the future, please return the agreement as soon as possible. We cannot ship your software without the agreement in house. Also, it would help me out if you'll fill in the back page with what programs or equipment you own

or have on order. If you are using our software with equipment from other sources, we'd like you to list that equipment also.

There has been a suggestion from a user that a radio communication be set up for ham operators. If any of you operate ham radios and would like your call number published, send it in and we'll try to get them in our next newsletter. You'll have to get it set up yourselves, but we'll help out all we can from here.

I guess that's it for this month. Take care!

Barbara

secret  
AND YOU READING

new MITS secret #

use it when you can't  
get through or when you just  
plain want  
fast access!

505-262-1951

### MITS-MOBILE CARAVAN SCHEDULE

note: All seminars are being held at Holiday Inns



AUG.11, Amarillo, Texas; #3 I-40 on I-40 at Ross.

AUG.12, Oklahoma City, Oklahoma; #5 South; I-35 at S.E. 29th St.

AUG.14, Tulsa, Oklahoma; #1 West; US 66, Alt. 75; I-44 and Oklahoma 33, exit at Turner Turnpike.

AUG.15, Fort Smith, Arkansas; #2 North; US 64 and 71 North; exit at Grand Ave., I-540.

AUG.18, Little Rock, Arkansas; #2 North; I-40, US 67 and St. 107.

AUG.19, Nashville, Tennessee; #2 Southeast; US 41-S, take Murf. Road exit from I-24.

AUG.21, Knoxville, Tennessee; #1 Northeast; US 70, 11E and 25 W. Ashville Highway exit.

AUG.22, Greensboro, North Carolina; #4 Airport; I-40 and 68, (Greensboro/Winston-Salem).

AUG.25, Raleigh, North Carolina; #1 North; US 1 and 401 N.

AUG.26, Charlotte, North Carolina; #4 North I-85; take I-85 at Sugar Creek exit.

AUG.28, Columbia, South Carolina; #1 Southwest; US 21, 176 and 321, five blocks off US 1.

AUG.29, Augusta, Georgia; US 1, 78, 278 at 25 S.

SEPT.2, Atlanta, Georgia; #7 at Six Flags West; 1.6 miles from the I-285 interchange.

SEPT.4, Birmingham, Alabama; #4 South; US 31 and I-65.

SEPT.5, Huntsville, Alabama; University Drive, US 72 and ST 53.

SEPT.8, Memphis, Tennessee; #1 Holiday City; US 78, I-240 and Getwell Road to Holiday City.

SEPT.9, Shreveport, Louisiana; #3 at Bossier City; off I-20 take the Hamilton Lane exit.

SEPT.11, Baton Rouge, Louisiana; #3 West; I-10 and Highway 415.

SEPT.12, New Orleans, Louisiana; #8 Airport; take Williams Blvd. exit from I-10.

SEPT.15, Mobile, Alabama; #1 West; Exit 90 East off I-10 from the west or West off I-65 or I-10 from the east.

SEPT.16, Tallahassee, Florida; #1 Apalachee; US 27 and Magnolia Dr.

SEPT.18, Jacksonville, Florida; #6 South; I-95 at Emerson Street exit.

SEPT.19, Titusville, Florida (Kennedy Space Center); Orlando/Cape Canaveral; take US 1 South exit I-95 and Florida 50 on Indian River

SEPT.22, Titusville, Florida; same location as above.

SEPT.23, Tampa Florida; #3 I-4 East; Tampa/St. Petersburg; exit I-4 and US 41 at 50th Street.

SEPT.25, Miami, Florida; #9; Central I-95 on I-95 at the 79th Street exit.

Hands-on demonstrations begin at 6 p.m. and all seminars begin at 7 p.m.

# Letters to the Editor

Dear Editor:

Thank you for the surprise package I received last week consisting of the Computer Notes, the People's Computer Company and the Computer Hobbyist, all of which I enjoyed thoroughly. I especially liked the note on the 4K RAM board regarding the data loss problem when using the reset switch and the hint about using the EI and the unconditional jump to the EI to indicate end of program on units without any I/O devices. I had experienced both of the above problems and it was reassuring to find out that they were not something that I had "done" (or not "done") during the construction of my Altair.

I would also like to take this opportunity to express my admiration to your company for the excellent (and I've built quite a few) quality of the Altair kit. I can tell that you people really care about your customers! I especially like the openness with which you admit mistakes, and we all make them.

Please add my name to your list of those satisfied Altair owners and publish it in any future directories.

Sincerely yours,  
Ross F. Housholder  
1725 Brooks Dr.  
Arlington, Tex. 76012

Dear Editor:

I was very glad to see your "Computer Notes"-- an excellent idea. Many of us Altair users will be programming with machine language, at least for awhile, so perhaps this publication can provide us with certain programming hints, arithmetic subroutines in particular. You demonstrated simple addition but I'm lost when it comes to manipulation of negative numbers, division, multiplication, numbers greater than 28, decimal points, etc. Perhaps you could help out here, via "Computer Notes." I would like to see a demonstration of the "ADC" and "SSB" instructions.

Issue #1 indicated users names would be published in future issues. This is also to authorize use of my name. Thanks muchly.

George Markel  
505 Cypress Point Dr., Apt. 38  
Mountain View, CA 94043

Dear Editor:

Thank you for the excellent issue of your "Notes". It is filled with helpful notes--even for someone well up on the Intel 8080. Page after page the reaction is high.

Re Hint #1 on Page 8, I note that occasionally (i.e. in the miscalled "general case") one needs to preserve contents of A

through the count test and the simplest way is to revive the "count-up" method one had to use in the old 8008 to step through memory (using a fast RST routine a la your Hint #2), thus Lx1.B, count; 2's complement LOOP:  
.....  
.....  
INR C  
JNZ LOOP 8 bytes!  
INR B  
JNZ LOOP

Of course, using RST and ...  
RNZ...RET one got this in only 4 bytes (Hint #2).

This is a quite trivial point.  
Thanks again-- and can you send the next issue?

Sincerely,  
Donald V. Weaver  
Jamaica, NY 11435

Dear Dave,

I would like to enter your software competition. While I don't have a program or sub-routine as such, what I do have is an additional software package that extends the range of applications of the Altair beyond anything now envisioned.

A brief write-up of my offering, complete with suggested pricing structure, is attached.

WOS	Write Only Storage
BLI	Branch and Loop Indefinite
HCF	Halt and Catch Fire
BBI	Branch on Burned-out Indicator
BPO	Branch and Power-off
II	Inquire and Ignore
AI	Add Improper
SRZ	Subtract and Reset to Zero
RI	Read Invalid
WNR	Write Noise Record
ED	Eject Disc
EIOC	Execute Invalid Op Code
RNR	Read Noise Record
DSP	Destroy Storage Protect
MDB	Move and Drop Bits
MLR	Move and Lose Record
MC	Move Continuous
RT	Reduce Thru-put
IOR	Illogical "OR"
IAND	Illogical "AND"
UCB	Uncouple CPU's and Branch
EO	Execute Operator
RBG	Random Bug Generator (Special Feature)
IIB	Ignore Inquiry and Branch

Listed below are the names and addresses of Altair users who have given us permission to print their names and addresses. Already, a number of users have corresponded with us about starting a local Altair Users Clubs in their areas. If you'd like to have your name published in the next Computer Notes write or call us giving your permission.

Wendell S. Rice  
Chief Engineer  
Data Documents Systems Corp.  
Merriam, KS

Software Package No. 69

Altair SUPER EXTENDED BASIC -- \$1495.00

When purchased with an Altair, 42K memory and either a duplex I/O board and 4K of write-only memory, you have our deepest sympathy.

#### INSTRUCTION STATEMENTS:

CCS	Chinese Character Set
BH	Branch and Hang
BSO	Branch on Sleepy Operator
DO	Divide and Overflow
RPB	Reverse Parity and Branch
ARZ	Add and Reset to Zero
WWLR	Write Wrong Length Record
SRSD	Seek Record and Scar Disc
RC	Read Chaos
TDB	Transfer and Drop Bits
EROS	Erase Read Only Storage
UER	Update and Erase Record
CM	Circulate Memory
MWM	Move and Wrap Memory
DIA	Develop Ineffective Address
LMB	Lose Message and Branch
SC	Scramble Channels
LC	Loop Continuous
BIM	Branch on Index Missing
CD	Create Data

Dr. Jack Crenshaw  
Comp-Sultants  
P.O. Box 1016  
Huntsville, AL 35807

John D. Turner  
Navseeact Japan  
Box Five  
FPO Seattle, WA 98762

Robert C. Rae  
1921 Dogwood Lane  
Vienna, VA 22180

Agoris Home-Made Candies  
Demo Agoris (owner)  
153 W. Pike St.  
Houston, PA 15342  
(412) 745-6670

Thomas L. Dixon  
P.O. Box 5086  
Santa Monica, CA 90405

Manley Nichols  
Box 344  
Henning, MN 56551

Charles Merritt  
1618 Randolph  
Topeka, KS 66604  
(913) 233-8785

Paul Potter Reinhardt II  
1120 Folkstone Apt. #6  
San Mateo, CA 94402

# ACR Update Info

by Tom Durston

Here is some information that we hope can be useful to 88-ACR owners.

First, ACR stands for Audio Cassette Recording, a method using audio frequencies to record digital information. However, you are not limited to using only cassette recorders for data storage. Any type of recorder with wow and flutter less than 0.5% may be used. If you plan to transfer tapes between machines, be sure tape speed is within 0.5% or you will have to record the test signal (125s) for speed correction alignment of the demodulator (R29). At the end of this article is an easy alignment procedure for aligning your ACR with a voltmeter which is just as accurate as using an oscilloscope and easier than using the input test program.

If you are getting basic on cassette, we recommend a music quality, A.C. only cassette recorder to guarantee speed accuracy and stability. We have found that Radio Shack offers a line of good cassette recorders as well as high quality cassette tape. We have used the model SCT-5C deck and the CTR-20B portable recorder with very good results.

The reason for requiring stable and accurate tape speed is due to the frequencies used (2025HZ=Logic 0, 2225HZ=Logic 1). The reason they are used is because they are also used in 103 type telephone modems for computer communications. A tape that is recorded on a recorder that is 1% fast, and played on a recorder that is 1% slow gives a 2% speed difference which is a 40HZ frequency change. Since the frequency difference between Logic 1 and Logic 0 is 200 HZ, the error signal is 40/200 HZ or 20%. This does not include instantaneous changes in speed (wow and flutter).

If the total error in transferring tapes between recorders is less than 20% there is no problem; if it is greater than 20% you will have to readjust the demodulator as described next.

To align your 88-ACR, we have found a new, easy, and accurate method utilizing a voltmeter. The principle being applied is that a D.C. voltmeter reads average voltage, and if you are measuring a square wave, you will read half the peak to peak voltage.

STEP 1: When the output test program in the 88-ACR manual is run (with or without recorder) the voltage on pin 25 (Transmit data) of the UART (I.C."M" of the 88 SIOB) should read about 2.5 volts DC, halfway between Logic 0 (0 volts) and Logic 1

(+5 volts). Note the exact voltage.

STEP 2: A). Deposit in memory:

ADDR	DATA
000	333
001	007

Input to ACC  
88-ACR Data Addr.  
B) Examine 000  
C) Single Step twice

This should allow you to examine data from I/O port #7. Data lights 0-7 will indicate the data being received from the recorder (when properly adjusted). This process may be used to examine data or status information from any I/O board; just change the address number.

STEP 3: Play the tape with the output test program recorded on it. Slowly adjust R29 so that the recorded data (125) shows on the data lights. Now measure pin 20 (receive data) of

and R13 for maximum reading. Reduce the volume again, if necessary, to keep the reading below 4 volts RMS. Go back and adjust again to get maximum peak. Note that this is not a critical adjustment. Turn the volume back up to max, and go back and recheck the adjustment in step 3.

This completes alignment of the 88-ACR. If it requires readjustment to play data recorded on another machine, do steps 2 and 3. The MITS Altair Basic cassette has the test recording on the beginning of the back side. If you are using the Basic cassette, be sure your 88-ACR is wired for 300 Baud and address 6 and 7.

# HARDWARE

## 8800 MOD

### (1) DEPOSIT PROBLEM (D/C board)

SYMPTOMS: Machine won't deposit at all or deposits all ones when using the front panel deposit switch.

FIX: Change the timing capacitors for the deposit single shot (IC G on the Display/Control board). Change C7 to 0.01MF, C8 to 0.1 MF.

### (2) 12 VOLT ZENER (CPU board)

SYMPTOMS: Zener running very hot.

FIX: Change R46 on CPU board to 43 ohms (Use either a 1W or 2W resistor). This should be done only if there are four or less cards on the bus. If there are more than four cards R46 should be 33 ohms.

### (3) AC SWITCH (Display/Control board).

PROBLEM: The tracks on the D/C board which connect the AC switch terminals to the pads where the switch wires are connected to the board have 115VAC on them. If these are inadvertently shorted to other tracks on the board several IC's are wiped out.

FIX:(a) remove the AC switch lines from the D/C board.

(b) Cut the tracks leading from the pads where the switch is mounted to the pads where the AC switch wires attach to the D/C board. Cut the tracks as close as possible to the switch pads so there will be no length of track with 115VAC on it.

--continued on page six

The voltage measured with the amplifiers clipping should be about 5 v RMS. Reduce the recorder volume until the voltmeter reads 2 or 3 volts RMS and adjust R9

(c) Slide about 1" of heat shrink tubing (3/32 to 7/64 diam.) over the AC switch wires. Solder these wires directly to the AC switch terminals. Slide the heat shrink tubing down so it covers the switch terminals and uninsulated ends of the switch wires. Heat the tubing once it has been properly positioned to keep it in place.

(4) CLOCK SPECS (CPU Board)

(a) Phase 1 pulse width (measured at 90% points), 60 nano-seconds minimum.

(b) Phase 2 pulse width (measured at 90% points), 220 nano-seconds minimum.

(c) Delay from leading edge (90%) of Phase one to leading edge (10%) of Phase 2. 130 nano-seconds minimum.

(d) Delay from trailing edge (10%) of Phase 2 to leading edge (10%) of phase 1. 70 nano-seconds minimum.

MAINTENANCE

by Paul Van Baalen

A good percentage of the people who have had trouble with their bits have shown this symptom. "All the data lites on at all times". Below is a list of the most common causes:

A. Check the mother board for shorts using VOM.

B. Insure that all regulated voltages are OK.

C. Make sure the memory is installed and the address strapping is correct. Be sure that the connector from the front panel for the data lines is on the CPU.

D. Are all the data lines high on the D/C board? If they aren't, check the continuity of the CPU connector.

E. Check the timing of 01 802.

F. Check the drivers J&H on the static memory board. These tri-state drivers need a low on pins 1&15 to pass a signal. If 1&15 are high the outputs of these drivers will be high all the time.

G. See if line 68 on the bus is high all the time. If it is, backtrack thru the logic. Most probable cause is ICG on the front panel being bad or a short or solder bridge in the vicinity of ICG.

H. Check IC's U&T on D/C board to insure the signal levels are correct, i.e.; no 1.5 volt levels as opposed to  $\leq 5V$  or  $\geq 4+VDC$ .

**Boo-Boo's**

The Status Signal  $\bar{W}_0$  is incorrectly labelled on the front panel as  $W_0$ .

There is a problem with the protect operation on the 4K RAM board. Pin 10 of ICT is tied to +5V and should be tied to ground. The easiest way to fix this is to lift Pin 10 of ICT and run a short jumper from the lifted Pin to Pin 11 of ICT which is tied to ground.

BYTE

BYTE

BYTE

BYTE magazine is out and it is as real as everyone imagined.

Subtitled "the small systems journal" BYTE is in many ways a sigh of relief for those computer freaks who were losing their eyesight trying to read all of the club newsletters.

What I mean is that BYTE is a very professional magazine. It looks nice and it is printed on high quality magazine stock that won't fall apart in time like many publications.

It is interesting to note that there are four columns of type on each editorial page and that it is right justified with no breaks between words. The purpose is to make BYTE convenient to read (especially for you speed readers out there).

OK, let's give BYTE an A+ for format--now how about content.

According to editor Carl Helmers in the first BYTE editorial, BYTE is "a monthly compendium of information for the owners and users of the new microcomputer systems becoming widely available at moderate costs."

Helmers goes on to explain that the content of BYTE is divided into the trilogy of hardware, software and applications. All well and good.

There are three very good articles in BYTE which I think live up to the trilogy concept-- they are WHICH MICROPROCESSOR FOR YOU?? by Hal Chamberlin, WRITE YOUR OWN ASSEMBLER by Dan Fylstra (with some super illustrations), and LIFE Line by Carl Helmers.

Chamberlin's article first describes then compares the various aspects of the Intel 8008, Intel 8080 and National IMP-16 microprocessors. While there are, of course, many points of possible disagreement,

Chamberlin demonstrates that he knows what he's talking about and that he knows how to organize and write his thoughts in a legible fashion (perhaps something he learned writing all those good articles for The Computer Hobbyist.)

Fylstra's article describes in general terms what assemblers do, scanning techniques, symbol tables, hashing methods and advanced "bells and whistles". While I wouldn't recommend writing your own assembler (unless you are an advanced hobbyist) this is a good article for understanding the assembler and how it works.

LIFE Line is the first of a series of articles about the computer game, LIFE. Besides describing the concept of LIFE (better than I've seen it explained elsewhere) Helmers is using this series as a vehicle to explain the art of programming with "real hardware and software systems". The goal of this series is an inexpensive hardware/software system for the home brew computer builder.

These three articles, I think, exemplify an attempt to make BYTE an exciting publication.

The rest of the articles in BYTE (with the possible exception of SERIAL INTERFACE by Don Lancaster) aren't nearly as well written or as topical as the above, but then they aren't too bad. (Carl Mikkelsen wrote an interesting article about recycling used IC's that convinced me you have to be half mad to attempt recycling used IC's).

All in all I'd give BYTE an A- for content (they have to have something to work for).

Is BYTE magazine something no computer hobbyist should be without? At this point in time, I'd have to say YES. --DB

## DON'T MISS THE BOAT!

This is the last opportunity to become a CHARTER SUBSCRIBER to BYTE... at the special Charter rate of \$10 per year.

Perhaps you've held off to see the first issue... perhaps you've just seen a friend's copy of BYTE... whatever the reason... send in your \$10 and be sure to get your next issue of BYTE hot off the presses.

If you are reading a pass-along copy, just mark the subscription order that you'd like your subscription to start with issue number 1.

--coupon from Computer Notes--

Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

BILL ME

Check for \$10 enclosed

Start with #1 BYTE

Bill BankAmericard or MasterCharge #

Start with #2 BYTE

My occupation \_\_\_\_\_  
mail to: \_\_\_\_\_

BYTE Peterborough NH 03458

# July Software Contest Winners Announced

by Bill Gates

The Altair software library has doubled in size with the acceptance of fifteen more programs into the library. Memory test programs seem to be the most popular. We have four already, and I plan to submit the program we use in-house to test the 4K boards. An exhaustive memory test should check for side affects, that is checking to make sure writing into one cell didn't affect another.

The second most popular type of program is a program to relocate other programs in memory. We received two this month, bringing the total to three. When the software library gets sufficiently large we will organize the programs into different groups, like test programs, game programs, BASIC programs, etc.

Two BASIC programs were submitted this month. A number of users who have BASIC up and running on their machines have told me they are writing their own special game program which they plan to submit to the library, so I expect a lot more Basic programs to be added to the library in the near future.

The winning major program this month (\$50) is TIC-TAC-Toe (#721751) written by Gary Tack. The switches are used for input and the lights for output. The computer always goes first, and never loses. The best you can do is draw. The computer's complete strategy is shown in a diagram that comes with the program.

The second place prize (\$25) goes to John Klein for his BASIC program that plays Blackjack (#730751). This is one of the first BASIC programs written specifically for Altair BASIC and it uses some of the nice features of 8K BASIC. The program is testimony to the fact that someone who has no previous experience with BASIC can pick it up and write a large, fun program in less than a week.

The first program I thought of writing when I got my Altair was one to display patterns in the lights. What gets displayed on the address lights when a program is running depends on the instruction being executed. A little experimentation to figure out exactly what gets displayed for each instruction is fun and takes only a short time. The major program winning third place (\$15) is FLASH (#722751) written by Mathew Smith. FLASH is a demonstration program that uses the lights for output. When it is run the lights count up and then down, but at varying rates of speed. Different initial patterns can be used to change the output.

The most active contributor to the library so far has been Lee Eastburn.

His sort program (#616751) is the winning subroutine this month. (\$25). It is a bubble sort, where two cells are exchanged when they are in the wrong order, and the data is scanned to find cells out of order until a complete scan is made during which no cells are found to be out of order. The size of items to sort and the sort field within the item can easily be changed.

The second place winner (\$15) RND (#722751), written by Roger Gulbranson, is a random number generator. This is an essential subroutine for any game program involving chance. A 16-bit number is generated using a generalized feedback shift register algorithm. This program can easily

#717752, #71753

Author: Dr. George Haller  
Length: 30 bytes each

One program does an ascending sort and the other a descending sort. Both use a bubble sort. The lists to be sorted consist of single bytes, all of which are used as the sort field.

#722751

Author: Herb Archer  
Length: 35 bytes  
Ram test program. Two different bit patterns are stored in each memory cell and checked for accuracy.

#717751

Author: Samuel Cook  
Length: 22 bytes  
The interrupt light on the front

# SOFTWARE

be modified to generate random numbers of any size.

Here is a list of programs accepted into the library since the last newsletter, along with a brief description:

#722751

Author: Roger Gulbranson  
Length: 35-80 bytes depending on how much data is used.

Generates 16-bit random numbers using generalized feedback shift register Algorithm.

#730751

Author: John Klein  
Length: About 200 lines of BASIC;  
plays Blackjack.  
Full instructions given with the program.

# 521751

Author: Dennis Bahr  
Length: 25 bytes  
RAM memory test program. Tests all locations between a lower and upper bound with all possible values.

#721753

Author: Mathew Smith  
Length: 44 bytes  
FLASH displays patterns in the lights. Good demonstration program.

#721751

Author: Mr. Tack  
Length: 240 bytes  
Plays tic-tac-toe. Uses the switches and lights.

#725752

Author: Daniel Lomax  
Length: 31 bytes  
Program that finds out where it is in memory and then relocates itself to the page in the switch register.

#724751

Author: Billy Wood  
Length: 40 bytes  
Ram memory diagnostic. Goes through memory testing locations with all bits on, and one off and vice versa.

panel is turned on and off in a loop that gets smaller and smaller, starting at 1.8 seconds.

#711751

Author: L.M. Eastburn  
Length: 180 bytes  
Program to relocate other programs. Modified instruction operands when appropriate.

#714751

Author: Donald Tork  
Length: 33 bytes  
Loads data from an ASCII device into memory.

#630751

Author: Jim Babcock  
Length: Basic, about 250 lines  
Plays famous Las Vegas card game.

#728752

Author: J.R. Scott  
Length: 36 bytes  
Translates some Baudot character codes to ASCII equivalent.

#616751

Author: L.M. Eastburn  
Length: 250 bytes  
Sort program using bubble sort. Allows specification of data size and sort field.

MY COMPUTER LIKES ME \*

A fun course by Bob Albrecht published by DYNAC

will be  
a BONUS TO FIRST  
1000 OWNERS OF

ALTAIR BASIC  
BASIC  
BRIATJA  
TAIR SOFTWARE

\* when I SPEAK OF BASIC

# Q and A -

## MONITOR EDITOR & ASSEMBLER BY PAUL WASMUND

Here are answers to some frequently asked questions about the monitor, editor and assembler. Any other questions you may have regarding these programs should be sent to Paul Wasmund.

Q. Does the monitor have any kind of file structure to eliminate the need to store each program on a separate audio cassette?

A. Yes, when files are created by either the editor or the assembler, a three-character file name is output as a header, along with the rest of the file. The monitor has commands that are used by the editor and assembler to search for such a named file.

Q. What devices are presently supported and what devices will be supported in the near future?

A. At present the teletype, computer and audio cassette are the only supported devices. We should have handlers for the line printer and disk shortly.

Q. Can I add other I/O handlers to the monitor to support specific devices I own?

A. Yes, room has been left in the monitors device table for the addition of other device handlers.

Q. Does the monitor support interrupts?

A. No, the monitor currently does not have any facility to handle interrupt I/O.

Q. How useful is the system monitor?

A. The monitor gives the programmer complete freedom from front panel manipulation, except in the case of a program infinite loop, and it allows the editor and assembler to use device independent I/O routines. If the user needs the memory used by the monitor he can write his own loader to load programs into the area previously used by the monitor. However, the text editor and assembler require that the monitor be resident when they are used.

Q. What is the capability of the editor?

A. At present the only commands that edit text are the insert, delete and replace commands. We plan to add an interline edit command, a string search command, and extend the three present commands to work with more than one line.

Q. In an 8K machine how much memory do I have for programs if I run them only with the monitor?

A. You have slightly better than 6K of free space with only the monitor in memory.

Q. Does the assembler generate relocatable code?

A. No, the assembler generates absolute code. It has a feature allowing the programmer to assemble programs for execution at any location in memory. Using this feature you can assemble a program

to run in the memory the assembler normally resides in.

Q. Since the paper tape reader on the teletypes sold by MITS cannot be controlled, how are assembly listings generated?

A. During assembly error messages are echoed in place of the 2 characters that would normally be echoed. At the end of assembly a symbol table is printed, which gives the location of all symbols used, a list of all symbols that are still undefined is output, and an inverse assembly listing can be generated.

Q. What is an inverse assembly?

A. The assembler has a program in it which goes through the memory just assembled into, and for any byte that it recognizes as an instruction it will output the mnemonic for that instruction along with the location that the instruction is in.

## GENERAL SOFTWARE

by Paul Allen

Q. Will MITS trade hardware for software? I'd like to write a FORTRAN, APL, etc. if MITS will give me a machine!

A. It is MITS present policy not to trade hardware for software or other services. Sorry. If you do develop software once you've purchased a machine, MITS will be glad to examine it for possible purchase or for license to MITS customers.

Q. What kind of programs are you looking for?

A. High level language (FORTRAN, APL, RPG) compilers or interpreters for applications programs written in BASIC.

Q. Do you know yet how fast the improved floating point routines are?

A. Yes. Version 3.0 of Altair BASIC will be about twice as fast as version 2.0. A FOR I=1 TO 10,000: NEXT loop takes about 14 seconds. A floating multiply takes about 5 milliseconds and a divide takes about 8 milliseconds. These last two times may vary significantly depending on the operands.

Q. Any other differences in 3.0?

A. Yes, the 8K version is not only faster, it is also about 100 bytes shorter, due to many long hours spent by our programmers optimizing the assembly code. No new features are present in 3.0. The 4K 3.0 is the same size as 4K 2.0 but it is two times faster.

Q. When will 3.0 be shipped to customers?

A. In early August. Customers who have already received 2.0 may obtain 3.0 for a copying charge of \$15.

Q. Do you need the system monitor or text editor to run BASIC?

A. No, BASIC has its own built-in program editor and I/O routines.

Q. Do you plan to offer applications programs and games in BASIC?

A. Some BASIC game programs have already been submitted to the users group. We plan to have some business applications packages (accounts receivable, payable, payroll, etc.), available before the end of the year. Precise prices and release dates are not yet available.

Q. How does Altair BASIC compare to other minicomputer BASICs?

A. Altair BASIC has more features per byte of memory than any other BASIC we know of.

Q. Do you need the DOS to run extended BASIC?

A. No. Both extended BASIC and the DOS use the same file structure and disk driver. Extended BASIC can run without the DOS and vice versa. Extended BASIC is designed for BASIC programming development in a disk environment, and the DOS is designed for assembly language programming development.

Q. What are your development plans at the moment?

A. We are working full speed on the extended BASIC and DOS. The 4K and 8K versions are essentially "frozen"; that is, we don't anticipate changing them except to make bug fixes.

## DEBUG

DBG-8800 is a powerful debugging tool for the ALTAIR 8800 computer. It requires 2K of memory, and any other memory may be used for the assembly language program being debugged. The DBG-8800 may be used to:

1) Display memory locations, registers, flags in any of the following modes:

- A.) Octal
- B.) ASCII
- C.) Decimal
- D.) Symbolic Instruction format (i.e. XRA A)

2) Modify memory locations, registers, or flags using the four I/O modes.

3) Set, display, or remove breakpoints in the program being debugged. Up to 8 breakpoints may be set at one time.

4) Begin or resume execution of the program being debugged either at a specified location or from the most recently encountered breakpoint.

DBG-8800 is available with complete documentation. The object binary and documentation cost \$25 (order as DBGOBJ). The source code costs \$75 (order as DBGSRC). Please specify paper tape or cassette when ordering. Delivery is 45 days.

NOTE: DBG-8800 resides in the top 2K of 8K. It uses an RST instruction for breakpoint insertion.

# FUN WITH ALTAIR BASIC

by Monte Davidoff

After loading BASIC, you may be ready for a little enjoyment from your Altair. Here are three short programs that illustrate some of the things that are easy to do in 8K Altair BASIC.

The first program wants two strings S\$ and W\$. The program finds all the occurrences of W\$ as a sub-string. (i.e. it finds all the places in S\$ that are exactly the same characters that are in W\$.) For example, if S\$="ABCDAB" and W\$="AB" then the program would say "AB" was found in S\$ starting at characters 1 and 5. Now let's look at the program.

The first thing we do is input S\$ and W\$. Notice that we can print text in an INPUT statement also. The next thing the program does is set the variable CN to Zero. (Remember you can have two character variable names in Altair 8K BASIC). CN will be used to count how many times W\$ is found in S\$. Next, we use the CHR\$ function to set Q\$ to a string one character long. 34 is the ASCII code for a double quote. Next we use the concatenation operator "+" to put quotes around W\$ and S\$. This is just so the printouts will look nice. Next comes the meat of the program.... I ranges from 1 to the number of characters in S\$. The MID\$ function will return as many characters out of S\$ as there are in W\$. If these are equal to W\$, we have found our substring. So, we add one to the count, CN, and print a message.

Remember that if the IF statement is true, the statements following the THEN will be executed. If the IF statement is false, we skip the statements on the same line and start at the beginning of the next line. In 8K Altair BASIC, if there is no variable given in the NEXT statement, BASIC will assume the NEXT is for the most recent FOR loop. Line 90 just prints out how many times we found W\$ in S\$. This program is just intended to show what kinds of things can be done with the string functions such as MID\$ and LEN.

The next program shows how you can use STR\$ to make your output look nice. This program produces a table of Pascal's Triangle. This table is used in probability. It is formed by starting with a one at the top and then adding the two numbers that appear to the upper right and left to form an entry in the next row. Notice the NEXT J,I in line 60 to end both for loops. The trick comes in printing the thing out to look like a triangle. The STR\$ function is used to convert the number to be printed to a string. Then the

LEN function is used to find out how many characters are needed to print the number. These are added together in line 90 to see how many characters will be used to print all the numbers in the line. In line 100 we find how many spaces to print between each number. We have 72-LL positions to fill, and we want to divide the number of spaces into groups. .5 is added to round to the nearest integer. Line 120 then prints the row out using the SPC function to print the correct number of spaces. The last NEXT in line 120 ends the FOR in line 80, so we repeat this procedure for each line in the triangle. The right side does not look as nice as the left side. This is because the terminal can only print a character at discrete positions on the paper. However, the program still shows the general idea of using the STR\$ function.

The third program is intended for people who already know about BASIC on an advanced level. While BASIC is a simple language, it still has the power to do complicated things. This program calculates N factorial (N!) where  $n!=n \times (n-1) \times (n-2) \dots 3 \times 2 \times 1$  and  $0!=1$ . So  $5!=5 \times 4 \times 3 \times 2 \times 1=120$ .

The program uses the fact that  $0!=1$  and  $N!=N \times (N-1)!$

The FOR loop in line 20 just sets up things so a table can be printed

in two columns. The subroutine in line 60 prints out the result. The STR\$ function is used to make the output look nice by having the exclamation mark come immediately after the number.

Now for the tricky part. The subroutine in line 40 calculates  $F=N!$ . In line 40, if  $N=0$  then we know F should be one and we RETURN because we are done. If  $N$  is not zero, Line 50 decreases  $N$  by one, and then GOSUB'S to line 40 again to calculate  $(N-1)!$ . The amount of times GOSUB'S can be executed with out a RETURN is limited only by how much memory you have. I ran these programs on a machine with 8K. Anyway, when the subroutine returns in line 50, the  $N=N+1$  updates  $N$  to the value it was before the GOSUB,  $F=N \times F$  updates  $(N-1)!$  to  $N!$  and then we return. If you are confused about this program, you might want to print out the values of  $N$  and  $F$  at line 40 before the IF statement. (i.e. type: 40 PRINT N,F: IF N=0 THEN F=1: RETURN). If confusion still prevails, do not worry about it. There are very few BASIC programs in which this type of trick is used. If you want to run this program in 4K Altair BASIC, change line 60 to: 60 PRINT N;"!"="F,:RETURN

----- Having Fun With Altair BASIC--Program One -----

RUN

GIVE ME A SENTENCE? THE RAIN IN SPAIN FALLS MAINLY ON THE PLAIN

GIVE ME SOME CHARACTERS? THE

"THE" STARTS AT 1

"THE" STARTS AT 35

"THE" OCCURS 2 TIMES IN "THE RAIN IN SPAIN FALLS MAINLY ON THE PLAIN"

GIVE ME A SENTENCE? I LIKE APPLES COOKED IN TURPENTINE

GIVE ME SOME CHARACTERS? ELEPHANT

"ELEPHANT" OCCURS 0 TIMES IN "I LIKE APPLES COOKED IN TURPENTINE"

GIVE ME A SENTENCE? A MAN LOOKED AT A CAT

GIVE ME SOME CHARACTERS? A

"A" STARTS AT 1

"A" STARTS AT 4

"A" STARTS AT 14

"A" STARTS AT 17

"A" STARTS AT 20

"A" OCCURS 5 TIMES IN "A MAN LOOKED AT A CAT"

GIVE ME A SENTENCE?

OK  
LIST

```

10 REM SEARCH FOR A CHARACTER IN A SENTENCE
20 INPUT "GIVE ME A SENTENCE";S$
30 INPUT "GIVE ME SOME CHARACTERS";W$
40 CN=0 : REM CN=NUMBER OF TIMES W$ OCCURS IN S$
50 QS=CHR$(34) : SQ$=Q$+S$+QS : WQS=QS+W$+QS
60 FOR I=1 TO LEN(S$)
70 IF MID$(S$,I,LEN(W$))=W$ THEN CN=CN+1 : PRINT WQS " STARTS AT" I
80 NEXT
90 PRINT WQS " OCCURS" CN "TIMES IN " SQ$ : PRINT
100 GOTO 20
OK

```

--program continued on page 10--

--ALTAIR USERS--  
continued from page 4

Jonathan Griffitts  
1030 Adams Circle  
#205  
Boulder, CO 80302

J.W. Klotz  
73 Red Ridge Rd.  
Levittown, PA 19056

Rabkin Realty Corp.  
c/o Morton Rabkin  
1028 Hatch St.  
Cincinnati, OH 45202

Bruce Sidlinger  
6201 Airline Rd.  
Dallas, TX 75205

Ron Santore  
1957 Huasna Dr.  
San Luis Obispo, CA 93401

Grant E. Johnson  
2322 West 13th St.  
Ashtabula, OH 44004

Walt Gerard  
15 Eastridge Dr.  
Council Bluffs, IA 51501  
(712) 322-7761 Office  
(712) 328-0634 Home

Edwin F. Hampton  
P.O. Box 45629  
Tinker AFB Branch  
Oklahoma City, OK 73145

Fred Patterson  
5711 Cornick Rd.  
Norfolk, Va. 23502

Howard Klein, DDS  
3914 103rd St.  
Corona, NY 11368

Daniel Lomax  
Community Data Systems  
203 E. Congress St.  
Tucson, Az. 85701

Gordon Scale  
152 Glebe Ave., Apt. 3  
Ottawa, ON Canada

2Lt. L.R. Sears III  
COB, 25th Signal Bn.  
Ft. Bragg, NC, 28307

Eric A. Bardeen  
Advanced Precision Industries Inc.  
870 North Davis Dr.  
Hampton, Virginia 23662

Ross F. Housholder  
1725 Brooks Dr.  
Arlington, Tex. 76012

William D. Roch  
5133 Catalon Ave.  
Woodland Hills, CA 91364

## HAVING FUN WITH ALTAIR BASIC--Program Two

OK  
LIST

```

10 REM PRINT PASCAL'S TRIANGLE LIKE A TRIANGLE
20 INPUT "HOW MANY ROWS"; R : R=R+1
30 DIM P(R,R)
40 REM GENERATE PASCAL'S TRIANGLE
50 P(1,1)=1 : REM INITIALIZE THE TRIANGLE
60 FOR I=2 TO R : FOR J=1 TO I : P(I,J)=P(I-1,J-1)+P(I-1,J) : NEXT J, I
70 REM PRINT THE TRIANGLE
80 FOR I=1 TO R : LL=0
90 FOR J=1 TO I : LL=LL+LEN(STR$(P(I,J))) : NEXT : REM LL=LINE LENGTH
100 SP=INT((72-LL)/(I+1)+.5) : REM SP=NUMBER OF SPACES BETWEEN NUMBERS
110 REM PRINT A ROW
120 FOR J=1 TO I : PRINT SPC(SP);STR$(P(I,J)); : NEXT : PRINT : NEXT
OK

```

## HAVING FUN WITH ALTAIR BASIC--Program Three

RUN

0!	=	1
1!	=	1
2!	=	2
3!	=	6
4!	=	24
5!	=	120
6!	=	720
7!	=	5040
8!	=	40320
9!	=	362880
10!	=	3.6288E+06
11!	=	3.99168E+07
12!	=	4.79002E+08
13!	=	6.22702E+09
14!	=	8.71783E+10
15!	=	1.30767E+12
16!	=	2.09228E+13

20U. EPREC. IN. 50

18!	=	6. 40237E+15
19!	=	1. 21645E+17
20!	=	2. 4329E+18
21!	=	5. 10909E+19
22!	=	1. 124E+21
23!	=	2. 5852E+22
24!	=	6. 20448E+23
25!	=	1. 55112E+25
26!	=	4. 03291E+26
27!	=	1. 08889E+28
28!	=	3. 04888E+29
29!	=	8. 84176E+30
30!	=	2. 65253E+32
31!	=	8. 22284E+33
32!	=	2. 63131E+35

```
OK
LIST

10 REM CALCULATE N! RECURSIVELY
20 FOR M=0 TO 17 : N=M : GO SUB 40 : GO SUB 60 : PRINT TAB(36);
30 N=M+18 : GO SUB 40 : GO SUB 60 : PRINT : NEXT
40 IF N=0 THEN F=1 : RETURN
50 N=N-1 : GO SUB 40 : N=N+1 : F=N*F : RETURN
60 PRINT STR$(N); "! = " F, : RETURN
OK
```

—continued on page 12